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(58) Field of Search

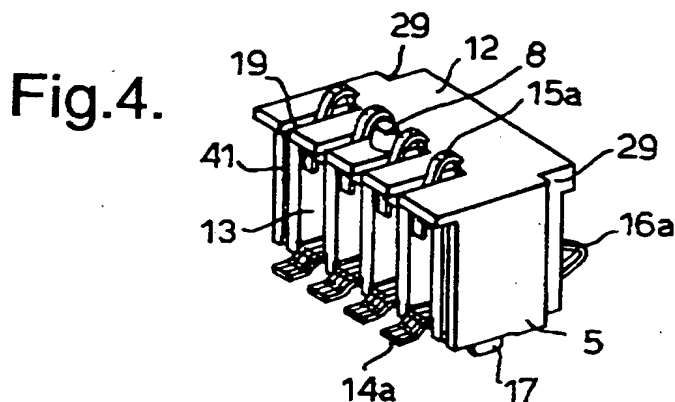
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(54) Abstract Title

Connector joining battery and two PCBs in mobile phone

(57) A surface mount electrical connector for use in electrically connecting two PCBs of a mobile phone to a removable battery therefor, the connector (5) comprising a housing (12) with at least one electrical contact mounted therein such that a first non-sprung portion (14a) protrudes therefrom for permanent connection to one PCB and second and third sprung contact portions (15a, 16a) protruding from the housing for releasable connection to the other PCB and the battery.



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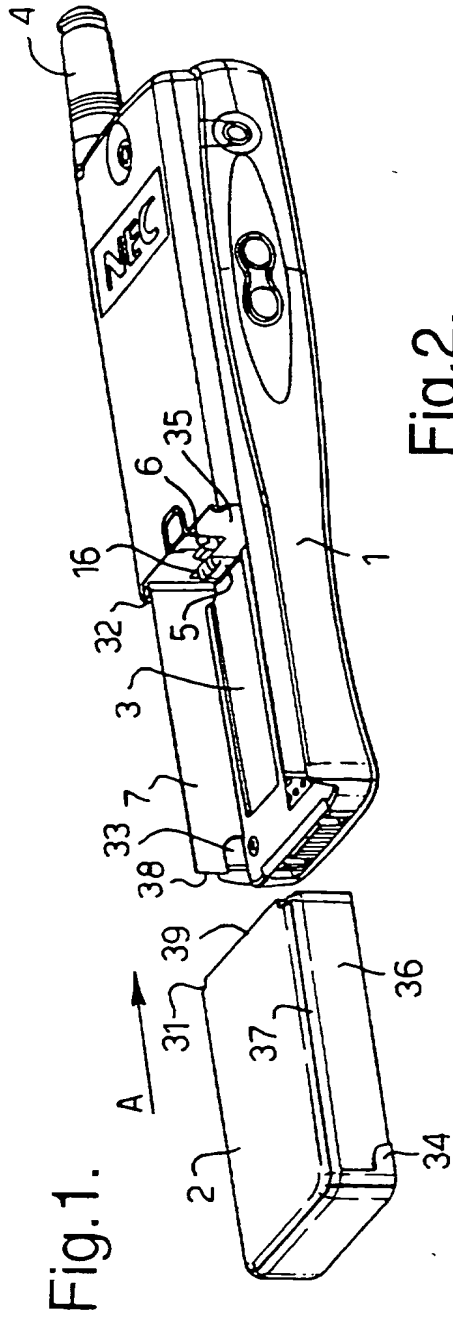


Fig.2.

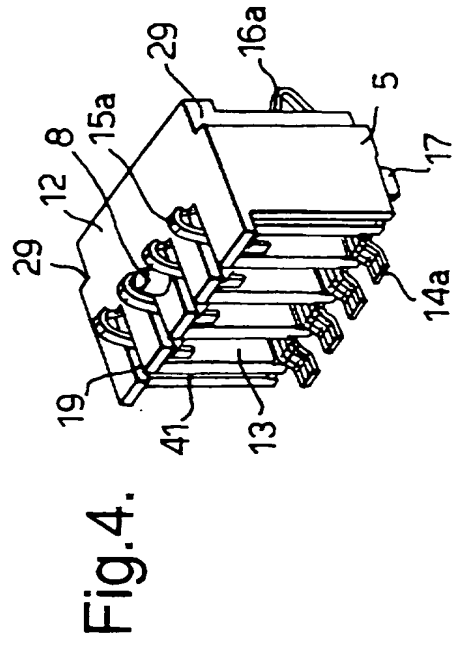
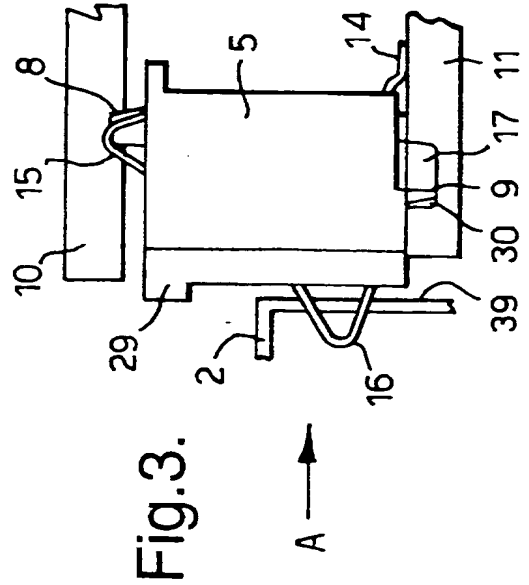
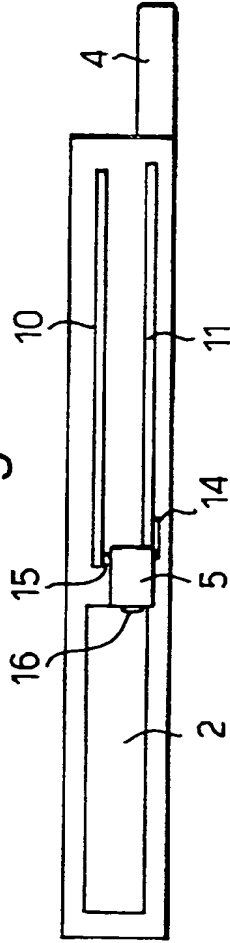


Fig.5.

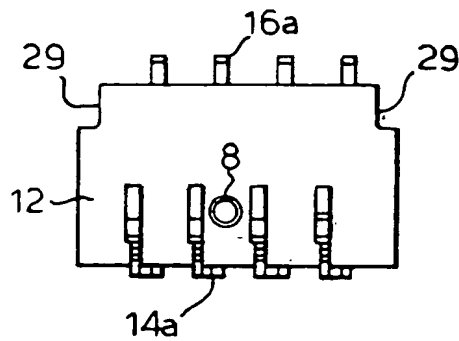


Fig.6.

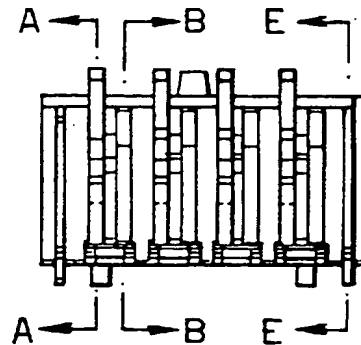


Fig.7.

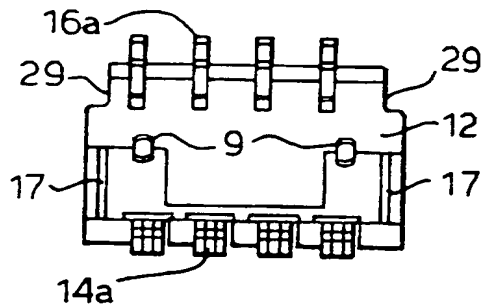


Fig.8.

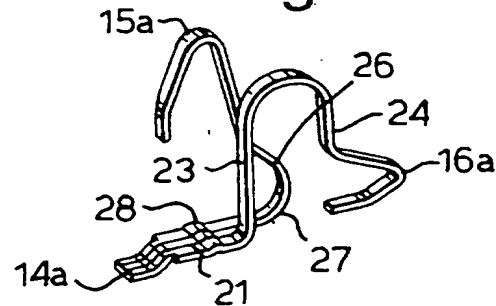


Fig.9.

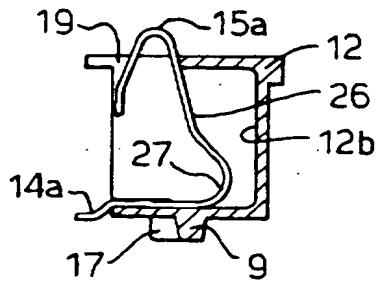


Fig.10.

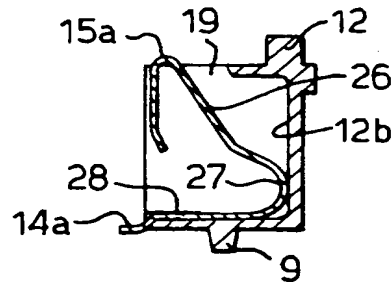


Fig.11.

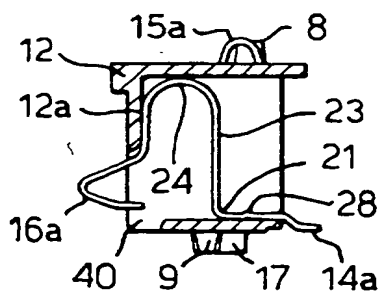


Fig.12.

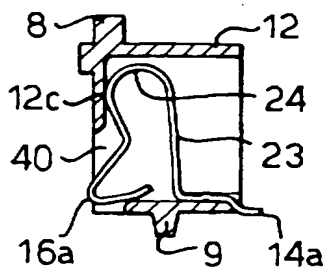
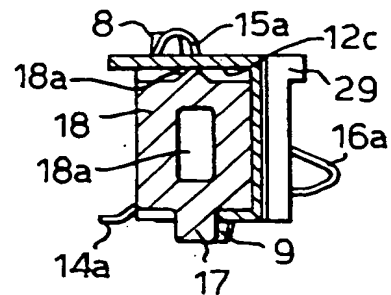


Fig.13.



MOBILE PHONE BATTERY AND PCB CONNECTOR

This invention relates to a connector for a mobile phone to electrically connect at least two printed circuit boards (PCB's) therein to each other
5 and also to the removable battery for the phone. The invention also relates to a mobile phone incorporating such a connector.

Mobile phones require the power from the battery to be connected to the separate PCB's therein. This is normally done in a phone having two
10 PCB's by using one connector from the battery to one of the PCB's and a separate second connector connecting that PCB to the other PCB. This arrangement is expensive to manufacture as two separate connectors are needed and it also uses up valuable space on the PCB's which can be a significant drawback when space is at a premium in very small compact
15 phones.

It is an object of the present invention therefore to overcome or substantially reduce this problem by using a single connector to electrically connect the battery to two or more PCB's in a mobile phone.
20

According to one aspect of the present invention there is provided a portable phone having at least two printed circuit boards (PCB's) therein powered by a removable battery, the PCB's being electrically connected to each other and the battery by a single connector comprising an
25 insulated housing in which at least one electrical contact is mounted, the or each contact having a first contact portion secured to one PCB, a second sprung contact portion making an electrical connection with the

other PCB and a third sprung contact portion for releasable connection to the removable battery.

5 Preferably the first, second and third contact portions are all part of the same metal conductor.

10 In the preferred embodiment, the second and third sprung contact portions protrude out of the housing for connection to the battery and one of the PCB's. Conveniently the second and third sprung contact portions are V-shaped and provided at the end of respective flexible limbs of the metal conductor, the contact portions being depressable relative to the housing.

15 Conveniently each limb has an intermediate portion shaped to locate the limb against movement in the housing.

20 Preferably a metal plate is mounted adjacent each end of the connector, each plate having a portion protruding from the housing which is received in a recess in the PCB to prevent movement of the connector relative to the PCB. Conveniently the protruding portion of each metal plate is a planar tab.

25 Preferably the first contact portion of the or each metal conductor is secured to said one PCB by soldering.

In the preferred embodiment, the second and third sprung contact portions protrude from the housing at substantially 90° to each other.

According to a second aspect of the invention there is provided a surface
5 mount connector for use in electrically connecting two PCB's of a
mobile phone to a removable battery therefor, the connector comprising
an insulated housing with at least one electrical contact mounted therein,
the or each contact having a first non-sprung contact portion protruding
from the housing for permanent connection to a PCB and second and
10 third sprung contact portions protruding from the housing for releasable
connection to the other PCB and the battery.

The invention will now be described, by way of example only, with
reference to the accompanying drawings, in which:

15

Figure 1 is a perspective view showing a portable phone incorporating a
connector of the invention with the removable battery which powers the
phone prior to insertion therein;

Figure 2 is a schematic cross section of the phone shown in Figure 1 but
20 with the battery fully inserted therein;

Figure 3 is an enlarged schematic cross section showing the connection
between the three-way connector and the PCB's and the battery;

Figure 4 is a perspective view of the three-way connector shown in
Figures 1-3;

25 Figure 5 is a top plan view of the three-way connector shown in Figure 4;

Figure 6 is a side view of the three-way connector shown in Figures 4 and 5;

Figure 7 is a bottom view of the three-way connector shown in Figures 4-6;

5 Figure 8 is a perspective view of one of the electrical contacts of the three-way connector shown in the preceding Figures

Figure 9 is a cross section of the connector shown in Figure 6 taken along the lines A-A;

Figure 10 is a cross section of the connector shown in Figure 6;

10 Figure 11 is a cross section of the connector shown in Figure 6 taken along the lines B-B;

Figure 12 is a cross section of the connector shown in Figure 6;

Figure 13 is a cross section of the connector shown in Figure 6 taken along the lines E-E.

15

Referring now to Figures 1 and 2, there is shown a mobile phone 1 with a detachable battery 2 and an extendable aerial 4. The phone 1 has a battery bay 3 with upstanding side walls or rails 7 along either side thereof and an end face 35 with catch 6 protruding therefrom for

20 engagement with end face 39 of the battery 2. Each upstanding side wall 7 has a cut-out 33 at its end furthest away from end face 35.

The removable battery 2 has inset side faces 36 with an overhanging lip 37 along the top edge thereof. Electrical contacts (not visible) are

25 provided on the front face 39 and locating projections 34 are provided on each side face 36 at the end thereof remote from front face 39.

To insert the battery 2 onto the phone 1, it is slid into the battery bay 3 in the direction of arrow A along the upstanding side rails 7 until the projections 34 locate in cut-outs 33 in the side rails 7. Once in this position, the contacts (not visible) on end face 39 of the battery depress the contact pins 16 which protrude from end face 35 into the battery bay 3 to make an electrical contact between the battery and the rest of the phone in a manner to be described in more detail hereafter.

Figure 2 shows schematically the general assembly of the phone 1 which comprises a first printed circuit board (PCB) 10 electrically connected to a second PCB 11 by the contacts 14 and 15 of a 3-way connector 5. The PCB's 10,11 are connected to the battery 2 by the contact 16 engaging with corresponding contacts on end face 39 of the battery 2 as has just been described.

Figure 3 shows on an enlarged scale the connection between the battery 2 and the PCB's 10 and 11 using the three-way connector 5 of the present invention. As can be seen more clearly in Figure 3, the connector 5 has a first fixed contact portion 14 protruding from one side thereof, a second sprung contact 15 protruding from the top thereof and a third sprung contact portion 16 protruding from the opposite side face thereof.

Metal tab 17 protrudes downwardly from the bottom of each end of the 3-way connector 5 and locates in a recess 30 provided in PCB 11 and is soldered thereto. The tabs 17 are a push-fit in the recesses 30 and their

purpose is to prevent any movement of the connector 5 in the direction of arrow A relative to the PCB when the contacts (not visible) on end face 39 of the battery 2 engages with the contact portion 16. It will be appreciated that without these locating tabs 17, the entire axial load applied to the battery 2 in the direction of arrow A when it engages the contact 16 would have to be taken by the relatively weak soldered connection between the contacts 14 and the PCB 11 so these connections would break in time. Additional location is also provided by a pair of pegs 9 extending from the bottom surface of the connector 5 (see Figures 7-13) which locate in corresponding recesses (not shown) in the PCB 11.

The 3-way connector 5 will now be described in greater detail with reference to Figures 4-13. Referring first to Figure 4, it can be seen that the connector 5 comprises a housing 12 having a plurality of compartments 13 therein. In the illustrated embodiment there are four such compartments in each of which is housed a contact 20 shaped as illustrated in Figure 8. The upper surface of the housing has a plurality of slots 19 therein through which sprung contact portions 15a protrude. Contact portions 14a protrude from the bottom of each compartment 13 and contact portions 16a protrude from the side face of the housing through apertures 40 (see Figures 11 and 12). A locating peg 8 extends from the top surface of the connector 5 for reasons to be explained hereafter. A rebate 29 extends along each front corner of the connector 5.

As can be seen from Figure 8, each contact 20 is formed from a single piece of sheet metal and comprises a base 21 having a first contact portion 14a at one end. A first limb 23 extends upwardly from the base 21 and has a U-shaped portion 24 at its top end which terminates in V-shaped contact portion 16a. A second limb 26 extends upwardly from the body portion 21 and includes a substantially U-shaped intermediate section 27 terminating in V-shaped upper contact portion 15a. An upstanding locating ridge 28 extends across the base 21.

10 This configuration of each contact 20 means that contact portions 15a and 16a are spring loaded in that portion 16a can be moved towards upstanding limb 23 and portion 15a can be moved towards base 21.

Figures 9-12 show how each contact 20 is located in the connector housing 12. Referring first to Figures 9 and 10 it can be seen that limb 26 of the connector 20 is located in the housing 12 with its U-shaped portion 27 spaced from wall 12b thereof and V-shaped portion 15a protruding upwardly out of the top of the housing 12 through slot 19. This configuration allows the sprung contact portion 15a to be depressed into the housing as shown in Figure 10 when the connector 5 is brought into contact with the upper PCB 10 (see Figure 3), downward travel of the contact portion 15a being limited when the U-shaped portion 27 contacts the front wall 12b (see Figure 10).

25 Figures 11 and 12 illustrate the way in which the upstanding limb 23 of the contact 20 is located in the housing 12 so that portion 16a protrudes

out of the side of the housing through the aperture 40, the U-shaped section 24 locating against inner surface 12a of the housing 12. With this configuration, the portion 16a is spring loaded and can retract into the housing 12 as shown in Figure 12 when contacted by the battery 2.

As already briefly mentioned, metal plates 17 are fitted in slots 41 in the housing 12 adjacent each end thereof. Each plate has a tab 17 at one end thereof, a central hole 18a and a pointed section 18b at its other end which locates the plate 18 against undersurface 12c of the housing 12.

The connector 5 is assembled in the phone 1 in the following manner. First of all the connector 5 is located on the PCB 11 by inserting the pegs 9 in corresponding recesses (not shown) therein (see Figure 3). At the same time, tabs 17 locate in recesses 30 in the PCB 11 and contact portion 14a of contact 14 can then be soldered to the corresponding conductive track (not shown) on the PCB 11.

Upper PCB 10 can then be placed in position above the connector 5 so that each peg 8 on the top surface of the connector 5 locate in a corresponding recess in the undersurface of the PCB 10. When the PCB 10 is finally in position, the contact portion 15 will be depressed slightly into the housing 12 of the connector 5 thereby ensuring a good electrical contact between the conductive track (not shown) on the underside of the PCB 10 and the contact 15.

As shown in Figure 3, contact portion 16 protrudes out of the sidewall of the housing 12 of the connector 5 and this can be depressed inwardly into the housing 12 when battery 2 is placed in position in the phone 1 as shown in Figure 2.

5

Although the connector 5 described and illustrated has four contacts 20 mounted in the housing 12, it will be appreciated that the number of contacts is not critical and any number can be used depending on the number of tracks on the PCB's to be connected to.

Claims

1. A portable phone having at least two PCB's therein powered by a removable battery, the PCB's being electrically connected to each other
5 and the battery by a single connector comprising an insulated housing in which at least one electrical contact is mounted, the or each contact having a first contact portion secured to one PCB, a second sprung contact portion releasably connected to the other PCB and a third sprung contact portion for releasable connection to the removable battery.
10
2. A portable phone as claimed in claim 1 wherein the first, second and third contact portions are all part of the same metal conductor.
3. A portable phone as claimed in claim 1 or claim 2 wherein the
15 second and third sprung contact portions protrude out of the housing for connection to the battery and said one PCB.
4. A portable phone as claimed in claim 3 wherein the sprung second and third contact portions are V-shaped and provided at the end of
20 respective flexible spring limbs of the metal conductor, the contact portions being depressable relative to the housing.
5. A portable phone as claimed in claim 4 wherein each limb has an intermediate portion shaped to locate the limb against movement in the
25 housing.

6. A portable phone as claimed in any preceding claim wherein a metal plate is mounted adjacent each end of the connector, each plate having a portion protruding from the housing which is received in a recess in the PCB to prevent movement of the connector relative thereto.

5
7. A portable phone as claimed in claim 6 wherein said protruding portion of each metal plate is a tab.

8. A portable phone as claimed in any preceding claim wherein the
10 housing is molded from a plastics material.

9. A portable phone as claimed in any preceding claim wherein the first contact portion of the or each metal contact is soldered to said one PCB.

15
10. A portable phone as claimed in any preceding claim wherein the sprung second and third contact portions protrude from the housing at substantially 90° to each other.

20 11. A portable phone substantially as herein described with reference to the accompanying drawings.

12. A surface mount electrical connector for use in electrically connecting two PCB's of a mobile phone to a removable battery
25 therefor, the connector comprising an insulated housing with at least one electrical contact mounted therein, the or each contact having a first non-

sprung contact portion protruding from the housing for permanent connection to a PCB and second and third sprung contact portions protruding from the housing for releasable connection to the other PCB and the battery.

5
13. A connector as claimed in claim 12 wherein the first, second and third contact portions are all part of the same metal conductor.

14. A connector as claimed in claim 12 or claim 13 wherein the sprung
10 second and third contact portions are V-shaped and provided at the end of respective flexible spring limbs of the metal conductor, the contact portions being depressable relative to the housing.

15. A connector as claimed in claim 14 wherein each limb has an
15 intermediate portion shaped to locate the limb against movement in the housing.

16. A connector as claimed in any of claims 12-15 wherein a metal
plate is fitted in the housing adjacent each end of the connector, each
20 plate having a portion protruding from the housing.

17. A connector as claimed in claim 16 wherein said protruding portion of each metal plate is a tab.

18. A connector as claimed in any of claims 12-17 wherein the sprung second and third contact portions protrude from the housing at substantially 90° to each other.

5 19. A surface mount connector substantially as herein described with reference to the accompanying drawings.



Application No: GB 9814087.4
Claims searched: 1 - 19

Examiner: Paul Nicholls
Date of search: 8 February 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H2E (ECSH, EEKD)

Int Cl (Ed.6): H01R 11/01, 11/05, 23/68, 23/72, 27/00, 31/00, 31/02

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2,301,953 A (DREWNICKI) - See fig 2	1, 12
A	GB 2,182,507 A (AT&T) - See fig 5	1, 12
A	EP 0,766,346 A1 (JAPAN AVIATION) - See fig 6	1, 12
A	EP 0,560,471 A2 (YAMAICHI) - See figs 7, 8	1, 12
A	EP 0,518,578 A1 (YAMAICHI) - See fig 1	1, 12
A	EP 0,194,758 A1 (GENERAL MOTORS) - See fig 1	1, 12
A	EP 0,018,654 A1 (WESTERN ELECTRIC) - See fig 2	1, 12

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